San Francisco Childhood Lead Prevention Program

Case Studies 1991-1997

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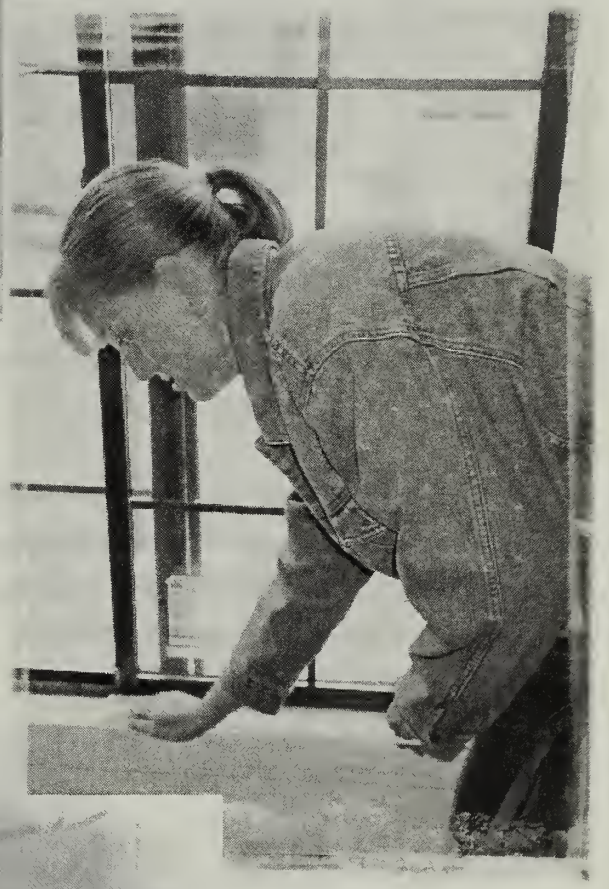
Acknowledgments

Special thanks to all of the Public Health Nurses and Environmental Investigators who are doing an exemplary job in serving the families with lead-burdened children.



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Introduction

The following case studies demonstrate a variety of childhood lead poisoning cases from various lead sources. Many of these cases dispel common myths regarding lead screening and case finding. Because we are attempting to represent all types of lead exposure situations, the number of cases presented does not represent the actual distribution of causes among our cases.

In reality, the majority of the childhood lead poisoning cases can be attributed to the fact that children are living in poor housing conditions in which there is a great deal of deferred maintenance. Many of these children live in a confined space with more than one lead hazard. These children are exposed to lead dust (generated by the deterioration of lead-based paint) during their normal hand-to-mouth behavior.

The following page summarizes a breakdown of the most common sources for lead exposure in 206 children with elevated lead levels that received an environmental investigation from 1991 to 1997.

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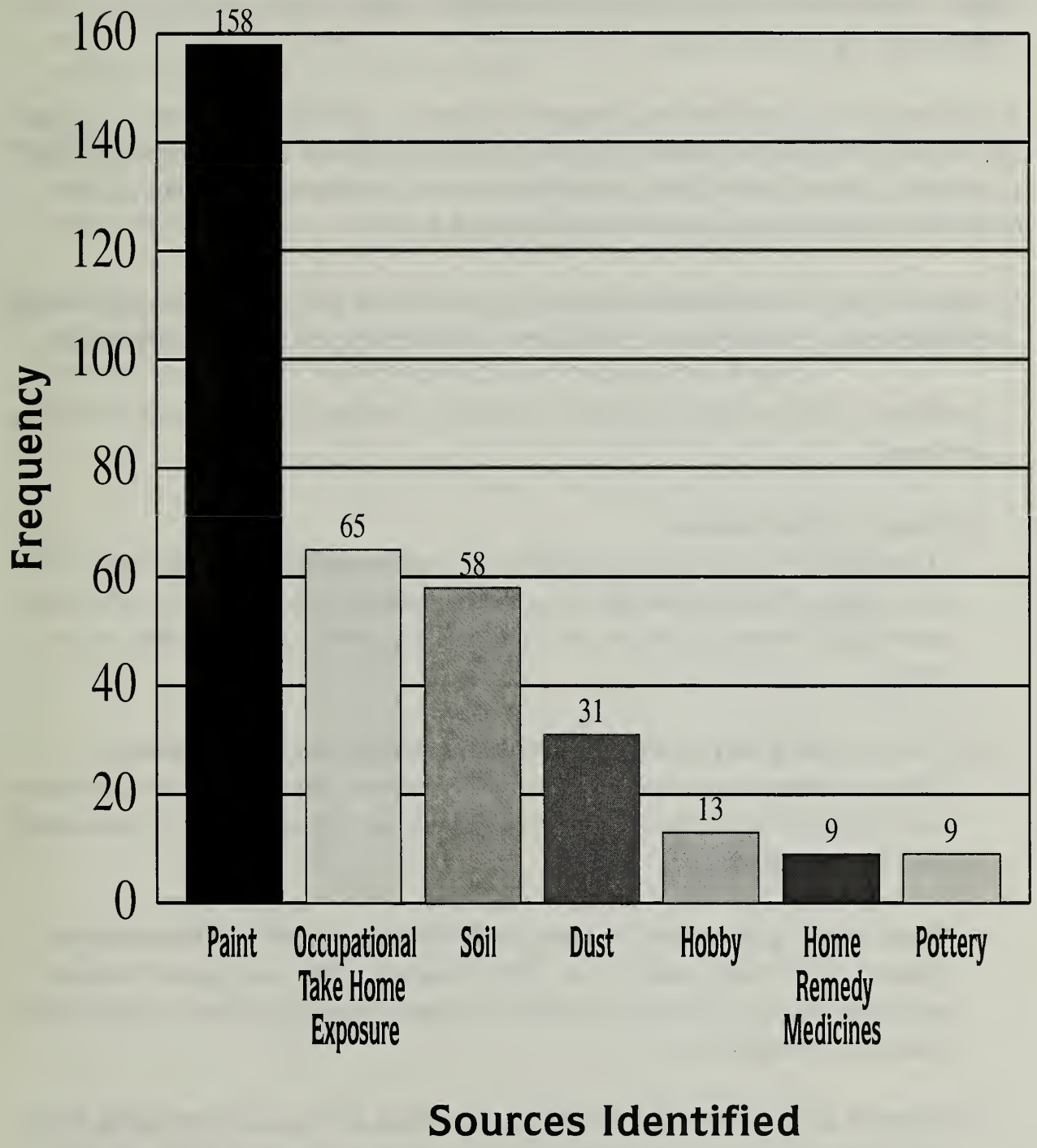
Common Sources For Lead Exposure

(Source findings for 206 cases who received an Environmental Investigator from 91-97)



Definition of Lead Hazards

Paint, soil, water, and dust may all be contaminated with lead. The lead will be hazardous and will affect children only when the lead becomes available to them. Lead becomes available to children if it can get into their bodies through ingestion. A normal developmental behavior for children is to put objects and hands into their mouths. Therefore, children usually ingest lead via hands that have been contaminated with lead dust, or by directly ingesting the paint chips.

A lead hazard is any condition that exposes children to lead from any source, including but not limited to lead-contaminated water, lead-contaminated dust, lead-contaminated soil, and lead-based paint. Environmental samples are considered to represent a lead hazard if the results are greater than the following levels:

☞ **Paint**. A paint is considered *lead-based paint* when any paint, varnish, shellac or other surface coating contains more 5000 parts per million (ppm) by laboratory analysis.

Lead-based paint becomes available to children when any of the following conditions are true:

✓ **Paint is deteriorated.**
[Deteriorated paint means any interior or exterior lead-based paint that is peeling, chipping, blistering, flaking, worn, chalking, alligatoring, cracking, or otherwise separating from the substrate, or located on any surface or fixture that is damaged.]

✓ **Paint is being worn away on a friction surface, such as a window.**
[Friction surface is any interior or exterior surface subject to abrasion or friction such that it is contributing to the deterioration of lead-based paint or generating lead-contaminated dust.]

✓ **Paint is being damaged by repeated impacts, such as on baseboards.**
[Impact surface is any exterior or interior surface subject to repeated impacts such that it is contributing to the deterioration of lead-based paint or generating lead-contaminated dust.]

✓ **Paint is on an accessible hazardous surface, such as a protruding interior window sill, where children can mouth or chew on the surface.**
[Accessible hazardous surface is any exterior or interior surface that is accessible, mouthable, chewable, and by contact constitutes a lead hazard to children.]

- **Dust.** Dust in residential dwellings is considered contaminated when samples from uncarpeted floors contain equal to or greater than 100 mg/ft^{2}, equal to or greater than 500 mg/ft^2 from interior window sills, or equal to or greater than 800 mg/ft^2 from exterior window sills and other exterior horizontal surfaces.

  Lead dust is generated from lead-containing soil or from interior or exterior paint that is damaged or deteriorated, such as peeling, chipping, chalking, cracking or flaking paint. When children touch surfaces with lead dust, the dust may get on their hands, and later from their hands to their mouth.

- **Soil.** When bare soil samples contain greater than or equal to 400 parts per million total lead, the soil is considered lead-contaminated. Lead-contaminated soil is hazardous to children when the soil is bare, without plants or other thick ground cover.

- **Water.** Lead-contaminated water contains greater than or equal to 15 parts per billion (ppb) of lead. The lead in water usually comes from either lead services lines, lead-soldered joints, or lead-containing alloys such as brass faucets.

Compliance Program

The San Francisco Childhood Lead Prevention Program (SFCLPP) has implemented a compliance program in which property owners are required to remediate lead hazards identified on a property where a lead poisoned child resides. (Lead poisoning is defined as one lead level greater than or equal to 20 µg/dL or two persistent levels of 15 µg/-19 µg/dL). The SF CLPP environmental investigator conducts an investigation of the relevant site(s) and sends a Notice of Violation which reports identified hazards to the property owner. The property owner is then required to fix the hazards within 30 days or face penalties and other corrective action. The majority of property owners have complied with the Notices of Violation and all lead hazards identified through this program have been remediated.

I. Lead Dust Hazards Related To Generalized Poor Housing Conditions:

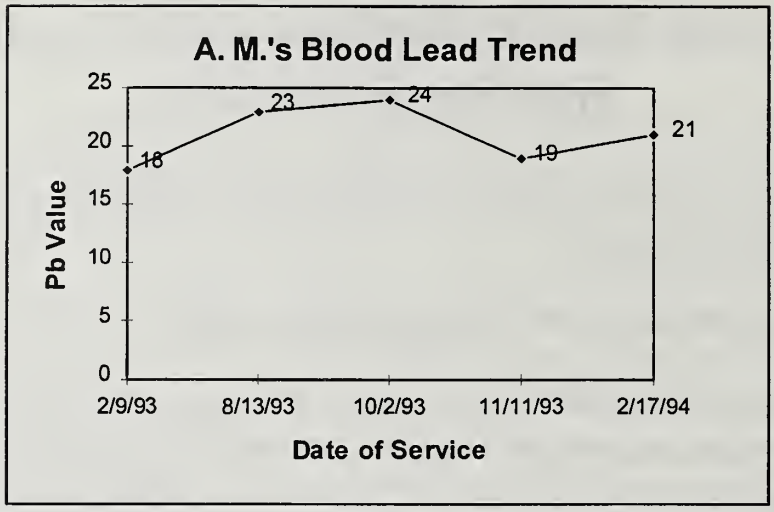
This is an example of a family with several children with elevated lead levels *before* the SF CLPP had compliance authority:

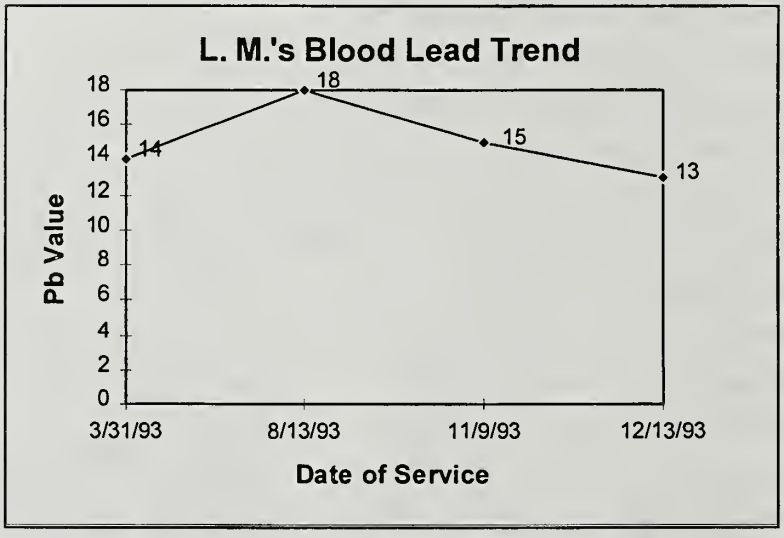
Patients A.M., L.M. and M.M., Barbara Towle, PHN:

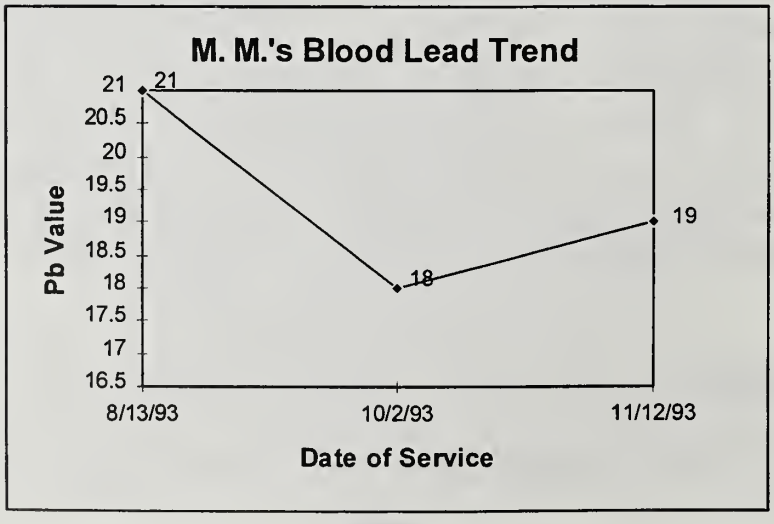
A single mother with three children, (a one-year-old, three-year-old and four-year-old) lived in a house which was owned by her grandmother. All three children had elevated lead levels (18 µg/dL, 18 µg/dL and 21 µg/dL respectively). The home was evaluated for paint and soil hazards only, as there was no laboratory capability to conduct lead dust analysis at that time. The primary source of exposure was believed to be lead dust generated from deteriorated paint. The exterior windowsill paint contained extremely high levels of lead and was in very poor condition. The lower wall in the kitchen contained extremely high levels of lead and was peeling. This was a very dangerous situation for the youngest child, as she had easy access to this wall as she was crawling. There were also high levels of lead in the soil in the living room flower boxes and in the backyard. Lead based paint was peeling and falling from the ceiling onto the carpet in the living room. This carpet was too contaminated to salvage due to dust tracked in from all parts of the house. The environmental investigator spent extensive time with the grandmother (who was the owner of the house) explaining possible remediation strategies. She was referred to qualified painting contractors who had specialized training in safe lead removal. However, this case was detected before the program had compliance authority and we had to rely on the voluntary efforts of the landlord. The children's lead levels did not go down, some even went up, and the family eventually moved to Oklahoma before the remediation was completed.

KEY POINT:

☞ ***Exterior Lead-Based paint can contain up to 50% lead by our tests.***

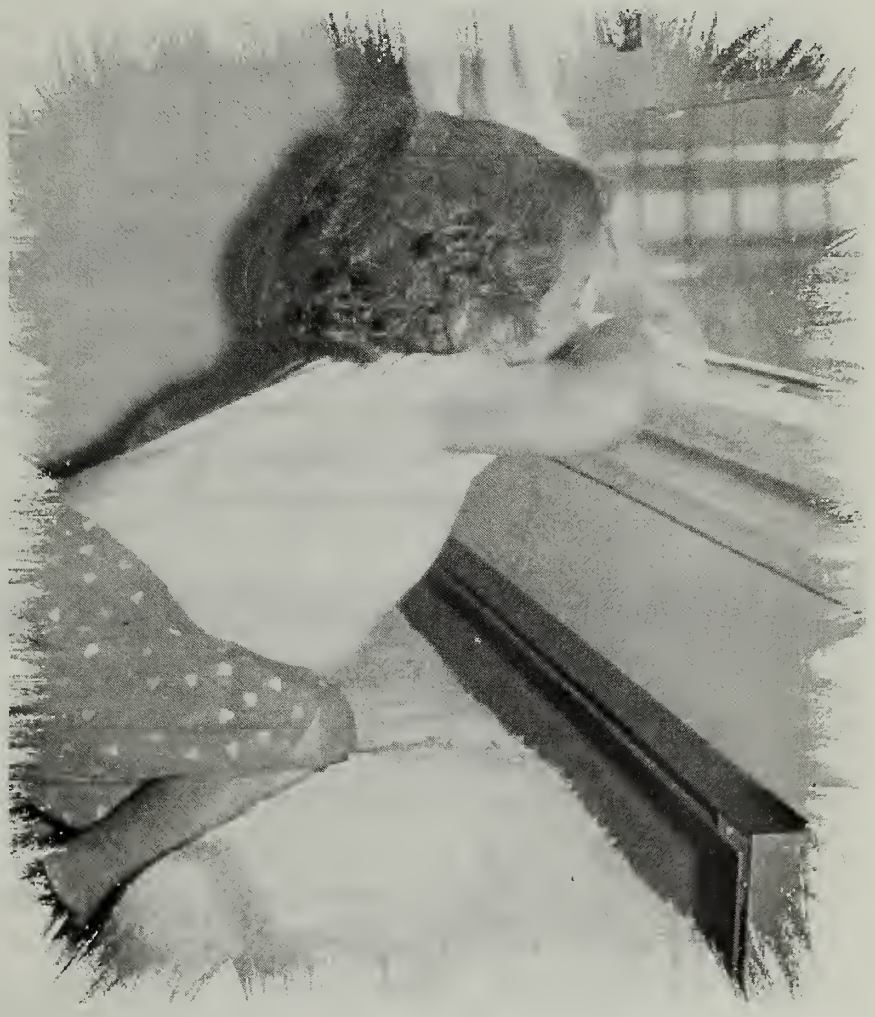

A. M.'s Blood Lead Trend
Pb Value
25
20
15
10
5
0
18
23
24
19
21
2/9/93
8/13/93
10/2/93
11/11/93
2/17/94
Date of Service

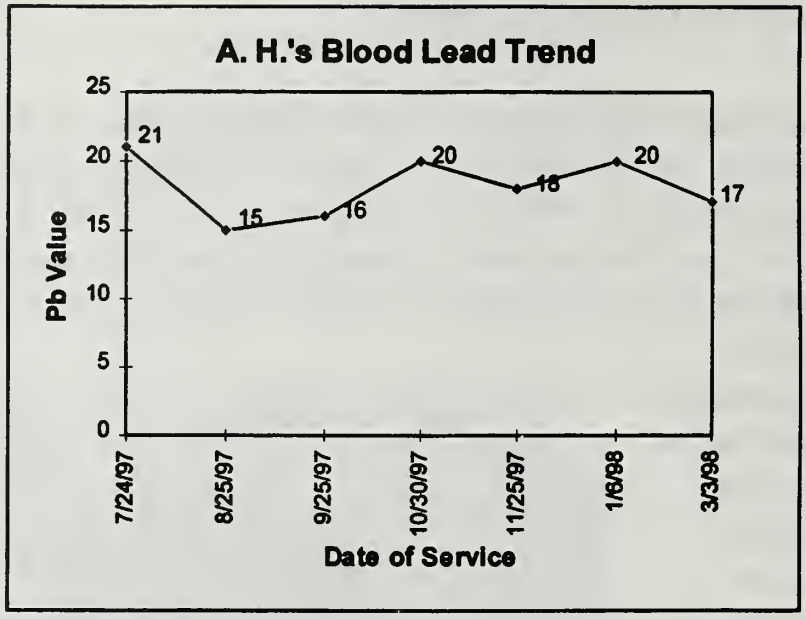

L. M.'s Blood Lead Trend
Pb Value
18
16
14
12
10
8
6
4
2
0
14
18
15
13
3/31/93
8/13/93
11/9/93
12/13/93
Date of Service

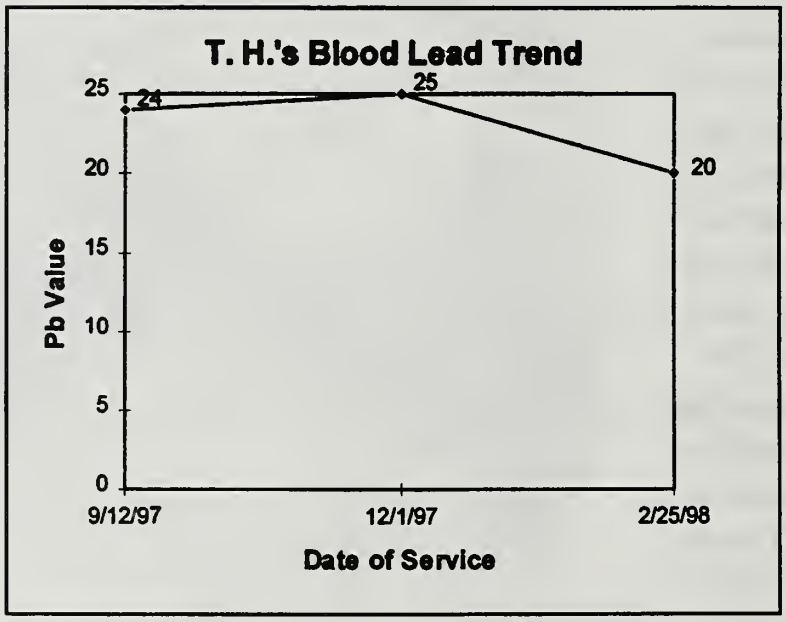

M. M.'s Blood Lead Trend
Pb Value
21
20.5
20
19.5
19
18.5
18
17.5
17
16.5
21
18
19
8/13/93
10/2/93
11/12/93
Date of Service

Siblings AH and TH: Mary China, PHN:

A two-and-a-half-year-old Vietnamese girl was routinely screened for lead at the SFGH Family Practice Clinic. Her lead level was 21 µg/dl. This child lived with her parents and two sisters, ages 6 and 16. The PHN encouraged the parents to test the older sibling TH who was 6 years of age. This child had an elevated lead level of 24 µg/dL. The entire family was unemployed and the parents were attending classes in English as a second language. The family spoke only Vietnamese and an interpreter had to be utilized during the home visit. The entire family lived in a one bedroom apartment and it was very confined quarters for the children. The family had lived in this house for twelve months out of the fourteen months they had been in this country. The major lead hazards were the exterior windowsills in both the living room (which contained 104 times the acceptable level of lead in paint) and the exterior windowsills in the bedroom (73 times the acceptable level of lead in paint). The children had easy access to both windowsills because the bed in the bedroom was right next to the window and the couch in the living room gave easy access to the exterior windowsill. The landlord, a non-profit neighborhood housing renewal corporation, hired a lead certified contractor to repair all of the exterior windowsills. The lead levels of both children declined to <15 µg/dL within nine months after the sources were identified and managed by our program. See the following graphs:




A. H.'s Blood Lead Trend
Pb Value
25
20
15
10
5
0
21
15
16
20
18
20
17
7/24/97
8/25/97
9/25/97
10/30/97
11/25/97
1/6/98
3/3/98
Date of Service


T. H.'s Blood Lead Trend
Pb Value
25
20
15
10
5
0
24
25
20
9/12/97
12/1/97
2/25/98
Date of Service

Patient V.M. and J.M.; Fele Mele PHN:

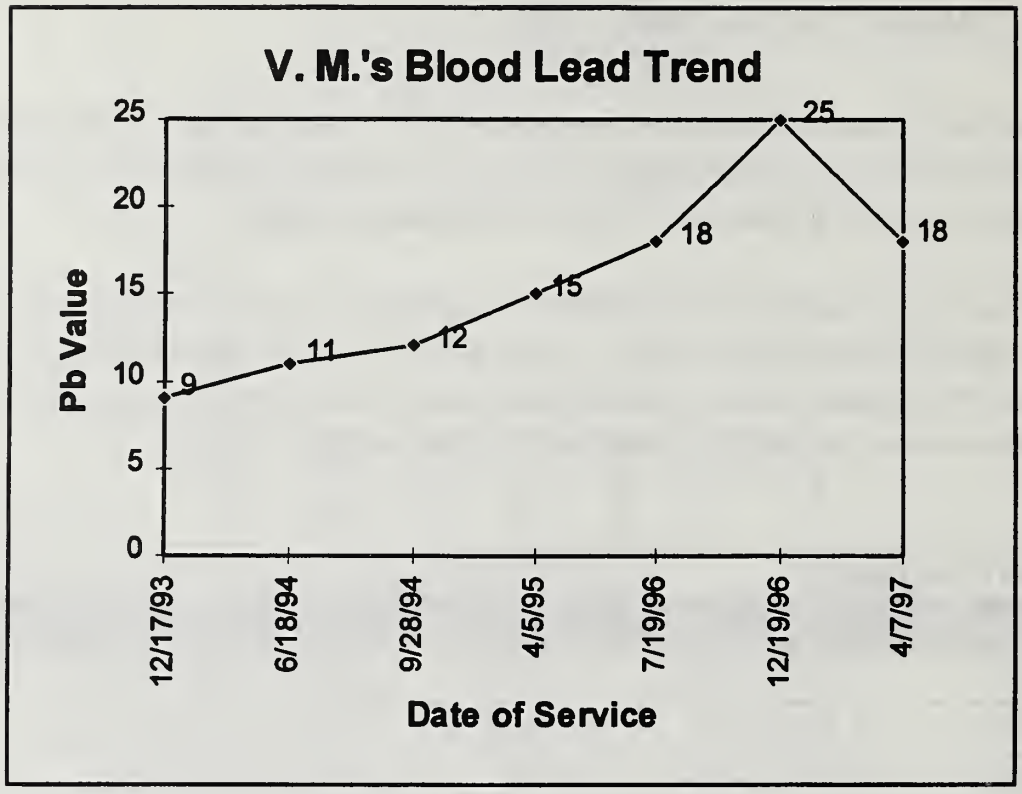
A two-and-a-half-year-old African American child was tested for lead at her routine physical and had an elevated lead level of 15 µg/dL. In addition, a four-year-old cousin, was exposed in the same environment. His lead level was 21 µg/dL.

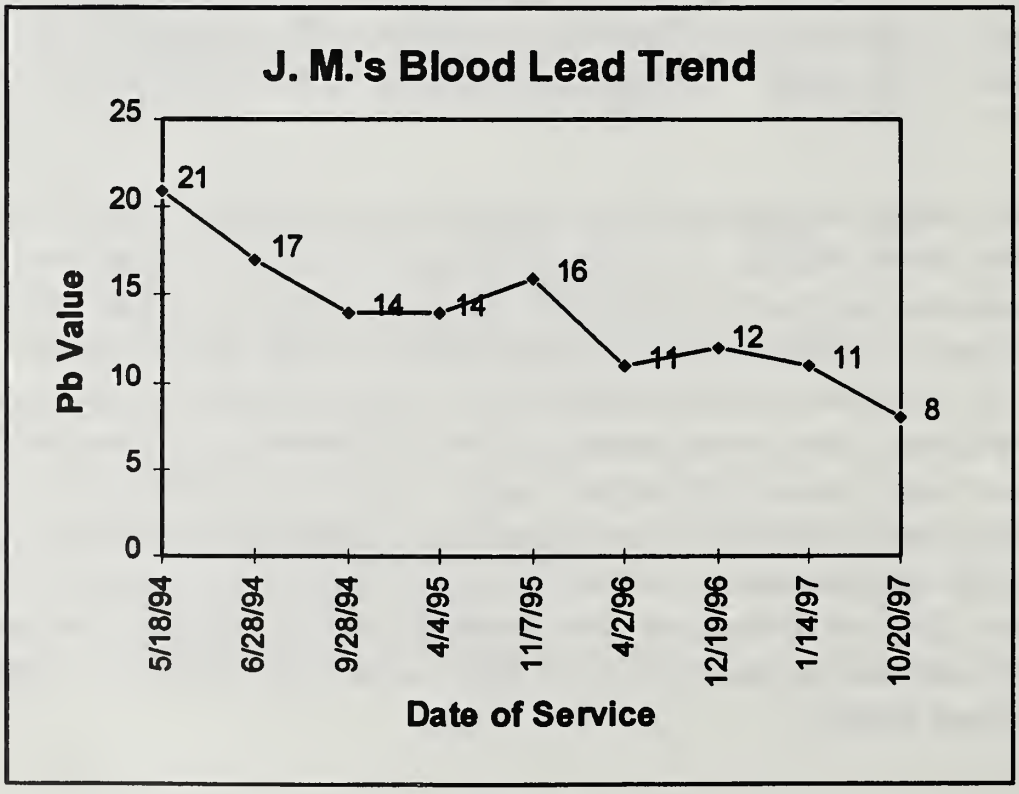
This home was evaluated for lead hazards by analyzing the lead content of paint in damaged condition, as well as lead dust on surfaces that the child was able to touch. The condition of the paint is crucial information because intact paint is not usually a hazard. The environmental investigation identified the following lead hazards:

PAINT HAZARDS:			
Location	**Component**	**Condition**	**Compared to HUD Standard**
Exterior	Window Stop	Poor	48 times greater than
Exterior	Windowsill	Poor	32 times greater than
Interior	Window Sash	fair	4 times greater than

DUST HAZARDS:			
Location	**Component**	**Condition**	**Compared to HUD Standard**
Exterior	Windowsill	Hazardous to children	1850 times greater than
Exterior	Concrete Patio	Hazardous to children	125 times greater than
Interior	Windowsill	Hazardous to children	119 times greater than

The child's mother had recently relocated to this address which is Section 8 housing. The CLPP referred this case to the Mayor's Office of Housing Lead Abatement program. In the meantime the aunt had received the report which cited the window sills as containing dangerous levels of lead. She scraped, sanded and repainted the window sills in an effort to remediate the lead hazards herself. Unfortunately, this caused an even greater dispersal of lead-contaminated dust than had previously been detected. The child's lead level rose from 15 µg/dL to 24 µg/dL. The SF CLPP staff then made an emergency visit to assist the family in cleaning up the lead dust hazard by wet cleaning and using a HEPA vacuum cleaner. The San Francisco Conservation Corporation, through the Mayor's Office of Housing, went in to restabilize paint and clean the lead dust from the windowsills and the patio by using the HEPA vacuum cleaner and wet cleaning all contaminated surfaces.

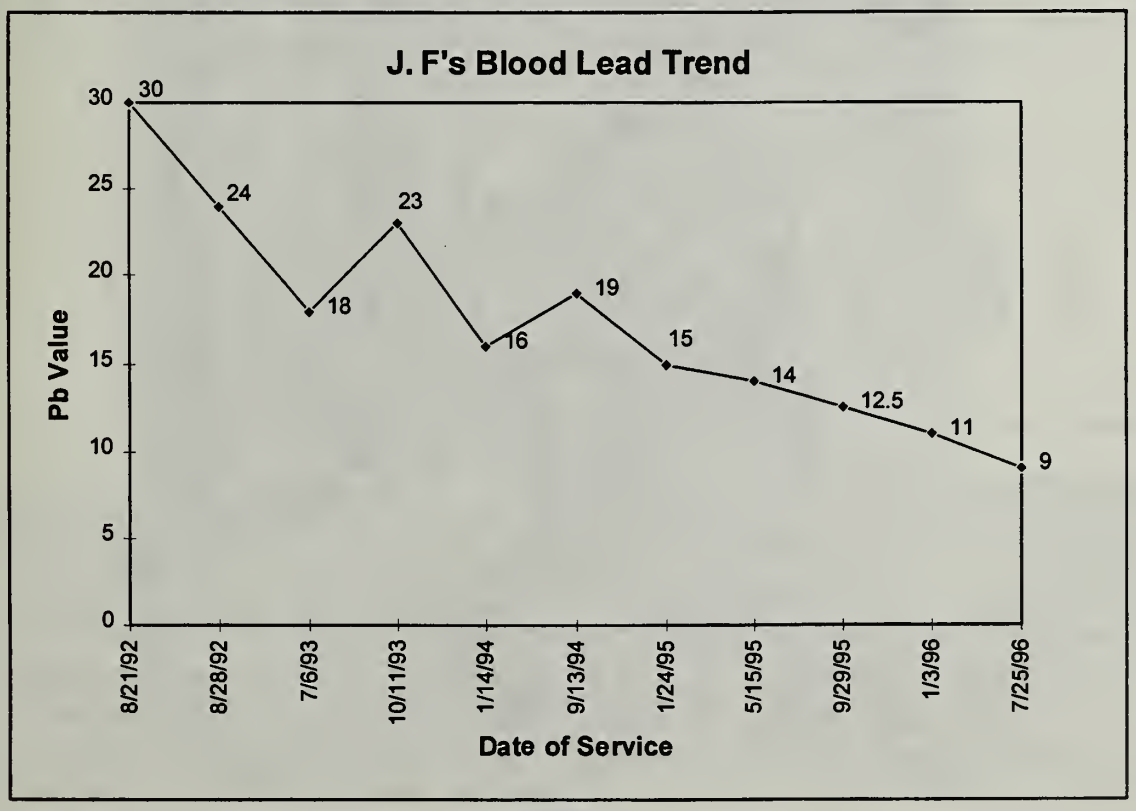

V. M.'s Blood Lead Trend
Pb Value
25
20
15
10
5
0
9
11
12
15
18
25
18
12/17/93
6/18/94
9/28/94
4/5/95
7/19/96
12/19/96
4/7/97
Date of Service


J. M.'s Blood Lead Trend
Pb Value
25
20
15
10
5
0
21
17
14
14
16
11
12
11
8
5/18/94
6/28/94
9/28/94
4/4/95
11/7/95
4/2/96
12/19/96
1/14/97
10/20/97
Date of Service

II. Lead Dust Hazard Exposure From Renovation And Remodeling Activities Or Occupational Take-Home Exposure

Patient JF, Jane Roach, PHN:

This case involves a one-year-old Hispanic child with a lead level of 30 µg/dL. The family was initially uncooperative because they feared eviction. They had lost their Medi-Cal status and feared having to pay for a test. The grandmother was the owner of the house, and she refused DPH entry for over one year. Paint was scraped from the exterior of the house, which had been constructed in 1906. The next door neighbor's house was power sanded down to the wood prior to the child's diagnosis. The house across the street was demolished and this also might have accounted for more lead dust. Repairs inside the house involved power sanding on painted surfaces. The family was encouraged to discontinue this practice and do good wet cleaning with a phosphate-based detergent at least weekly. They were told to throw out the rags and sponges used for cleaning. The front yard had very high levels of lead (nine times the EPA mandated level of concern), while the back yard soil contained 1.4 times the level of concern. When the family painted the living room walls and the hallway they wet scraped the old paint as opposed to dry scraping, which had caused the generation of lead dust. The front yard was partially covered with cement. The lead level gradually decreased.



KEY POINTS:

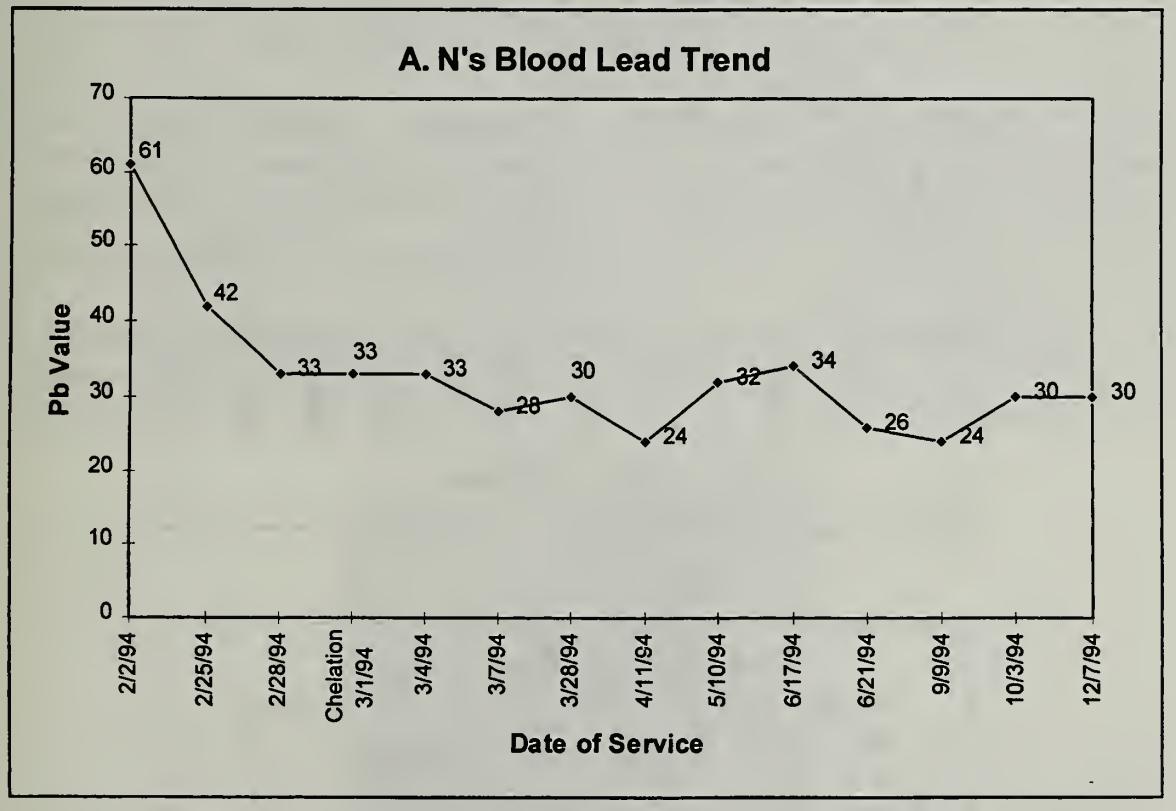
- *The San Francisco Department of Public Health has continually received complaints from citizens who complain that their neighbors are practicing unsafe work practices, such as dry scraping of lead-based paint, sand blasting, power sanding, etc. They complain that their neighbors are distributing lead dust onto their property. Until recently the SF DPH had no legislative authority to deal with these complaints. However, on January 5th, 1998, new legislation took effect which regulates exterior lead paint safe work practices. All landlords and contractors must contain lead paint debris and dust and clean up effectively. The Department of Building Inspection is the enforcement agency for the new Building Code (Chapter 36).*

- *Some families are initially reluctant to cooperate with our program due to fear of eviction or retaliation from their landlord.*

- *The EPA no longer recommends cleaning with a phosphate-cleaning detergent because limited research shows that using water and a general cleaner work just as well. The reasons they are discouraged is because they are toxic, dull finishes (such as hardwood) and are typically used in too strong of a concentrate.*

Patient AN, Diane Melnick, PHN:

A two-year-old Hispanic child from El Paso, Texas had a venous blood lead level of 61 µg/dL on a routine lead screen. He was also slightly anemic (Hct/Hgb=11.4/35.1). The child had been chewing on lead-based doors and window sills, and sucking on batteries. The interior paint on the window sills had an extremely high lead content. The landlord entered the apartment without tenant approval and began scraping paint according to orders received in a NOV (Notice of Violation) from the Department of Building Inspection (DBI). The dust generated from this activity, without proper controls and cleaning, may have caused a re-exposure to the child and his cousin. As a result of this incident, and the involvement of subsequent legal representation, the Department of Public Health (DPH) went back to look for evidence of lead dust distribution, but found none. Legal actions were in progress on behalf of this family from a non-profit tenant rights organization. The child eventually moved back to El Paso, Texas.

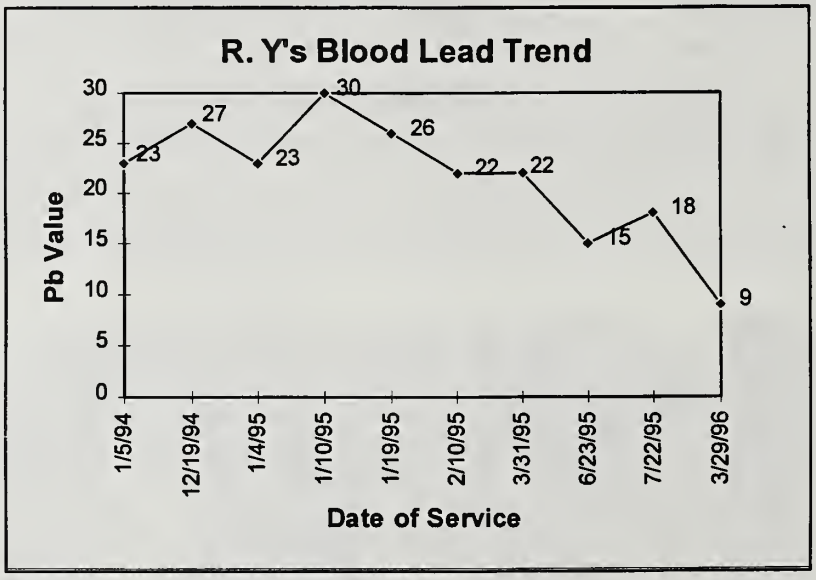


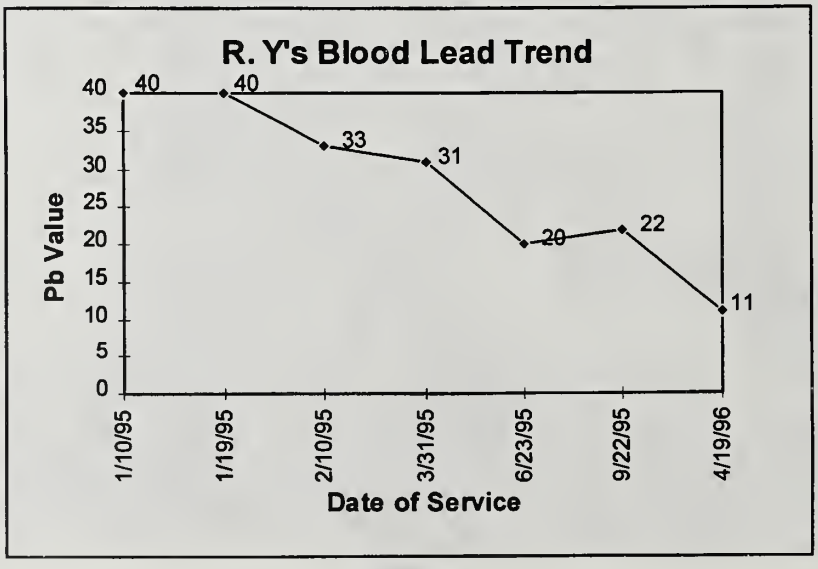
KEY POINT:

- ***This incident with DBI and the landlord who dry scraped paint according to their nonspecific order "to scrape peeling paint", resulted in some major policy changes regarding the language used on all code violation orders. This marked the beginning of a productive partnership between DBI and DPH.***

Patients R & RY, Doris Tom, PHN:

Two Cantonese-speaking brothers, a three-year-old and a one-and-a-half-year-old, were given routine lead tests by their primary care physician. The one-and-a-half-year-old had a blood lead level of 40 µg/dL; his older brother had a lead level of 26 µg/dL. The PHN did not find much evidence of flaking paint, ceramics or home remedies. The father of the two boys did tell her that he had scraped and removed all of the exterior paint on the front of the house prior to his children's diagnoses. This had created a great deal of dust in the children's environment. Evidence of residual lead dust was found between banisters of the hall stairwell, a location where the children had frequent access. This indicated prior lead dust dispersion. The carpet was assumed to contain lead dust and the family was urged to borrow a HEPA vacuum for clean up. An uncle at the same address also brought home lead-containing dust on his clothes from construction work.





KEY POINTS:

- *This is a case in which two siblings were exposed to the same hazardous home environment from renovation activities. Greater hand to mouth exposure is found at the developmental stage of the 1.5 year-old. This illustrates why a child should be screened at one and at two-years of age because their developmental activities and subsequent exposures will be different.*

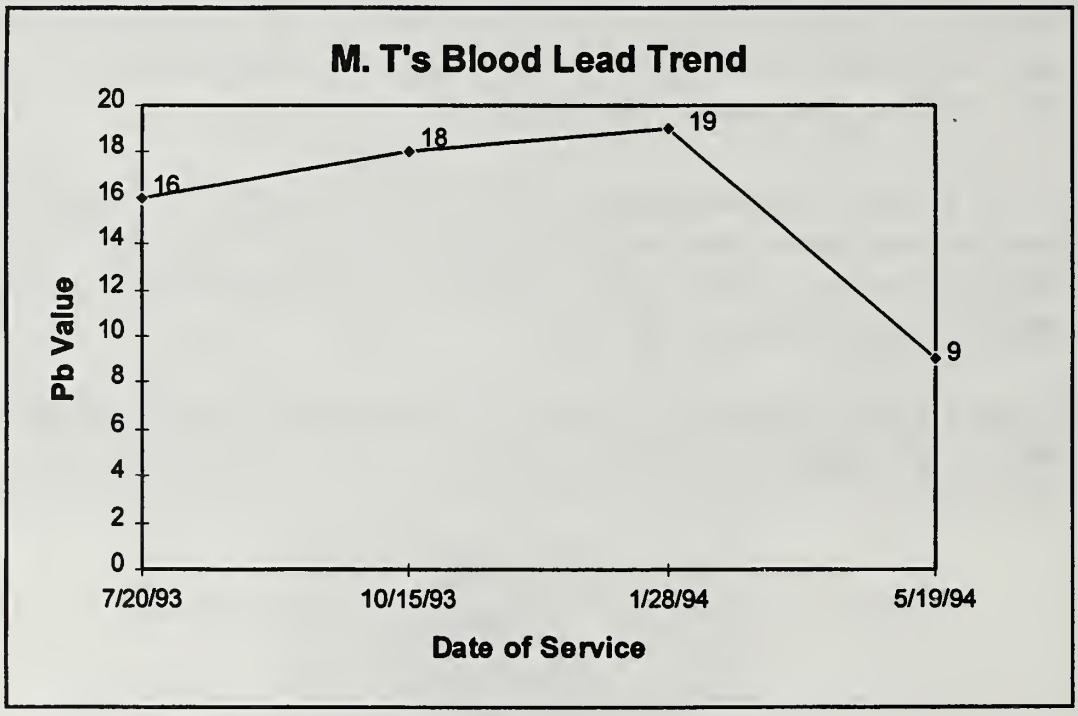
- *Lead-based paint deteriorates into a very fine dust which sticks to surfaces in the environment. Normal vacuum cleaner filter bags are unable to capture lead dust, as the particles are too fine. Instead the DPH recommends use of the HEPA Vacuum, which stands for "High Efficiency Particulate Air Filter". These are specialized vacuum cleaners that vacuum and trap extremely small particles of matter, including lead dust. The SF CLPP has a special program in which all families of children with elevated lead levels are offered free rental of a HEPA-Vacuum through Cole Hardware.*

- *Some cultural groups, recent Asian immigrants in particular, prefer fingerstick blood draws opposed to venous draws due to cultural beliefs in which they feel that a person loses "life energy" from blood loss. Their perception is that less blood is lost from the fingerstick draw.*

- *Concern about the payment mechanisms for the lead test can be a major disincentive for parents.*

Patient MT, Jane Roach, PHN:

This is a 16-month-old Caucasian child who had an initial venous lead level of 16 µg/dL. Her father is a building contractor. The entire back wall of the exterior of the house was sanded to the wood before it was repainted. There was a considerable amount of dust observed along the baseboards and in the carpet. The child had been chewing on a brown stained windowsill. There were high levels of lead in the paint on the wall of the bathroom below the sink. The child's father removed and replaced the interior sill of the living room window and painted the bathroom to remediate lead hazards. He implemented all of the abatement recommendations made by the Lead Program.



KEY POINTS:

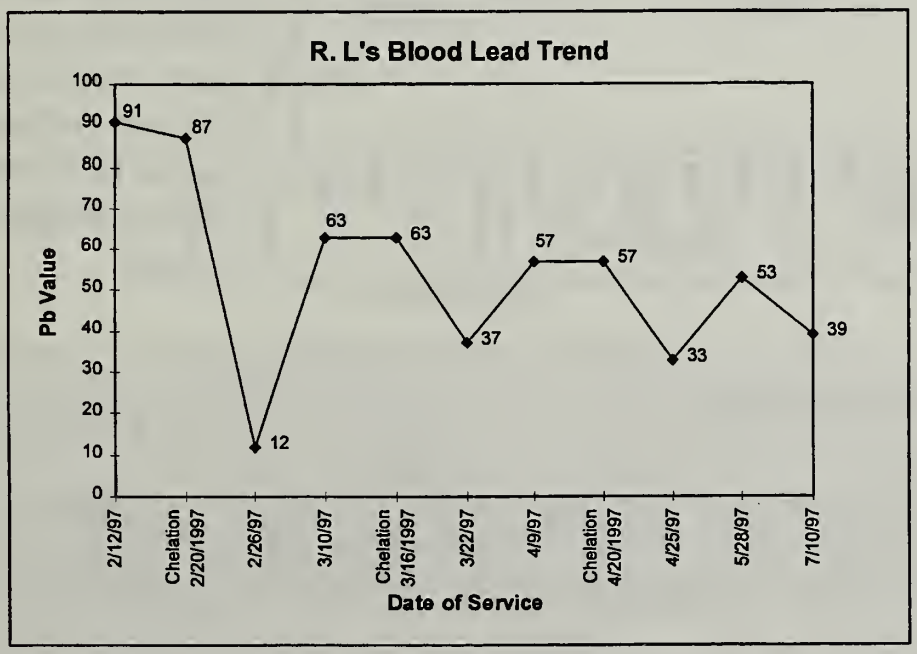
- ***This is a case in which the father of the child with the elevated lead level worked in an occupation where they potentially brought home lead dust on their clothes, shoes and in their vehicles. Our program has found that the most common form of take home exposure is from paint related occupations.***

- ***This was a moderate income Caucasian family who does not fit the traditional stereotype that only minority low-income children are lead-poisoned.***

III. Paint Hazards From Pica Or Mouthing Behavior, Accompanied By Iron-Deficiency Anemia

Patient RL, Pat Lowe, PHN:

A 3-year-old Asian boy had an initial lead level of 91 µg/dL. The physician ordered the lead test because the child appeared anemic (Hct 26, Hgb 7.5). He exhibited extreme pica behavior and chewed on windowsills both at his primary residence and at his grandmother's home. The painted surfaces where the child chewed were found to have lead levels up to seven times greater than the HUD definition of lead-based paint. At the home visit it was also learned that the child drank an excessive amount of cow's milk (almost 8 glasses per day), which could have contributed towards his iron deficiency, anemia and pica behavior. The lead hazards in the child's home and at his grandmother's home were remediated by the child's father, even though he had been advised by CLPP staff to hire a lead-certified contractor. The child has been chelated 4 times. He was hospitalized and initially treated with EDTA and BAL, and subsequently exclusively EDTA. He then underwent two subsequent oral chelations in the home with succimer. His lead levels and chelation episodes are outlined as follows:

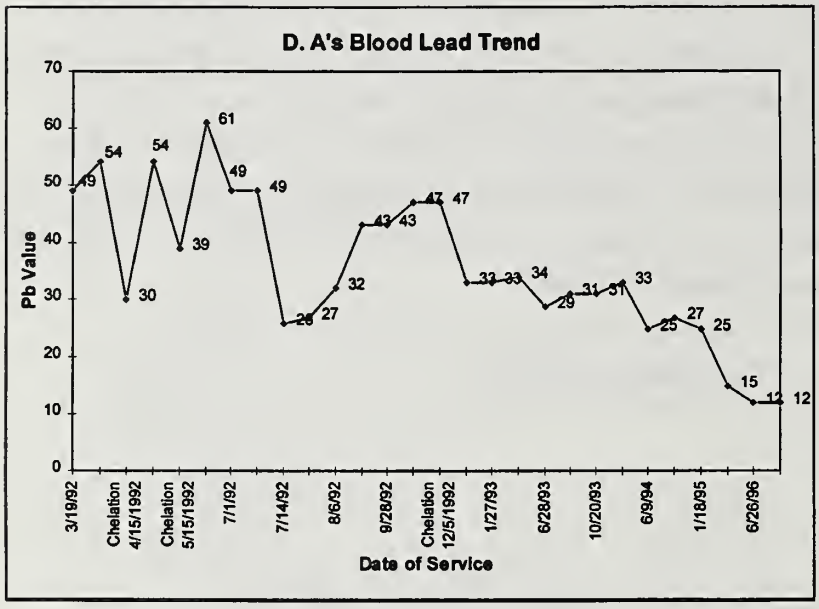


KEY POINT:

☞ ***Lack of iron in the diet increases lead absorption from the digestive tract and decreases lead excretion by the body. Iron deficiency and elevated blood lead levels often exist together in children.***

Patient DA, Doreen Yui, PHN:

This patient is a two-and-a-half-year-old Hispanic male from a family of eight children. The child was routinely screened at MNHC for lead and had an initial lead level of 54 µg/dL. The child was also anemic (Hgb/Hct=9.2/30). X-ray findings were positive for dense metaphyseal bands on his femur which indicates that this was a chronic lead exposure. The child was likely exposed in a house in the Mission District where his family had lived for seven years, and where the child had chewed on the windowsill on a daily basis over a period of several months. This house was built in 1907 and likely contained a high percentage of lead based paint. At the time of diagnosis the family was in a state of crisis as they had been recently evicted from their home and the father was incarcerated.



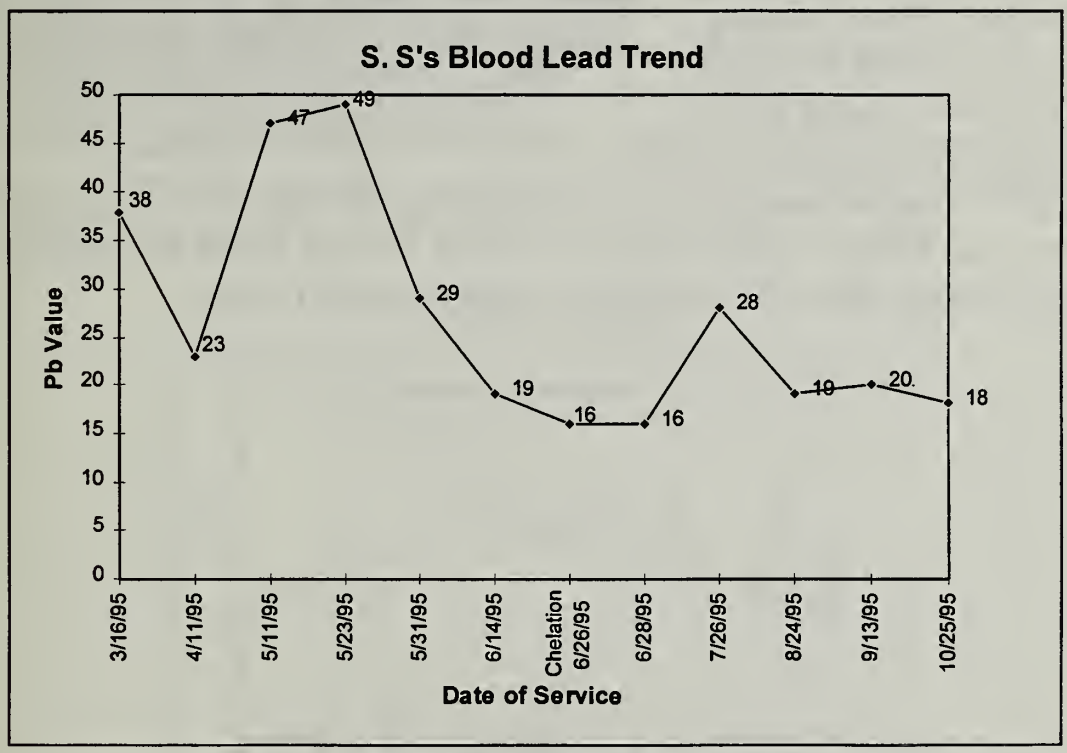
The family was temporarily located in a homeless shelter before finding a place to live in a Housing Authority Development. The child was chelated a total of 4 times. Two times in the hospital with DMSA and EDTA, followed by two times in the home with oral succimer. His lead level remained high from 3/19/92 until 6/25/96 when it had been reduced to 12 µg/dL.

KEY POINTS:

- ***Children who eat too little often eat nonfood substances. Excessive eating of nonfood items is called "Pica". If this includes eating lead-contaminated soil or chewing on lead-painted surfaces, lead will be easily absorbed.***
- ***Some children with high chronic lead levels have a high body burden of lead in their bones which can take some time (in this case, almost four years) to excrete lead from the body, even if the initial source of exposure has been eliminated.***
- ***Case families are often dealing with extreme social and economic issues which can affect lead outcome.***

Patient SS, Diane Melnick, PHN:

A 19-month-old child of Roma ethnicity (Gypsy) had an initial venous lead level of 38 µg/dL at a routine physical by his physician in the Mission District. The lead level increased to 47 µg/dL one month later. He was quite anemic, (9.2 Hgb/28 Hct and a Ferritin of 8). The family moved frequently and it was difficult for the PHN to reach them. They had lived in various residences during the previous year. The child was referred to the CCS lead specialist based out of UCSF, where he received a complete evaluation. Paint chips were seen in his stomach in an X-Ray. He was then placed on the oral chelation agent "succimer" for two weeks at home.



KEY POINTS:

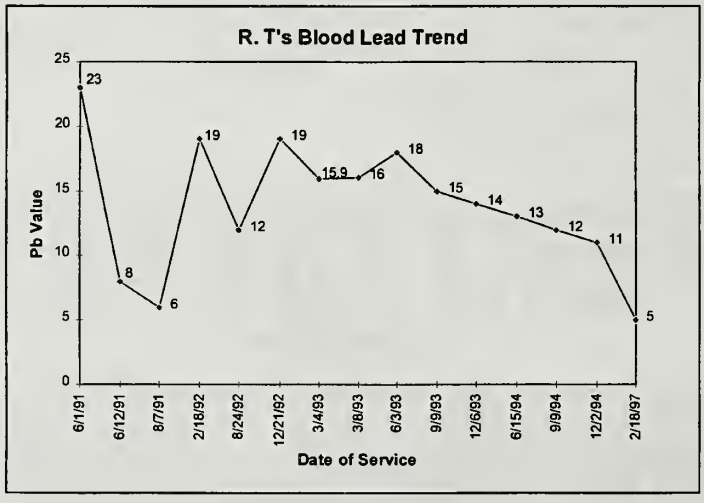
- ***Many children in our case load are extremely mobile. Some move from one address to another as often as two to three times per year. This often makes it difficult for the PHN to make contact with the family and to determine where the lead exposure occurred.***

- ***Lead levels of 20 µg/dL are considered a "CCS eligible condition". All children with these levels are automatically referred to CCS for any future problems with payment. This could be useful if the child is low income and will require extensive follow up or chelation therapy. There are three designated specialists in San Francisco who should supervise chelation therapy on lead burdened children, in coordination with the original treating physician.***

IV. Soil Hazards

Patient RT, Nora Kabasares, PHN:

This is a two-and-a-half-year-old child that had an initial venous lead level of 23 µg/dL. In the initial home investigation it was discovered that the child's bedroom door, door jamb, and the soil under the stairs had high levels of lead. Initially, the child's blood lead level dropped, but re-bounded to 19 µg/dL six months later (see graph). A second investigation was conducted in which the soil next to the carport and garage was found to contain high levels of lead. This soil was then covered by cement through the Mayor's Office of Housing Lead Hazard Reduction Program.



KEY POINTS:

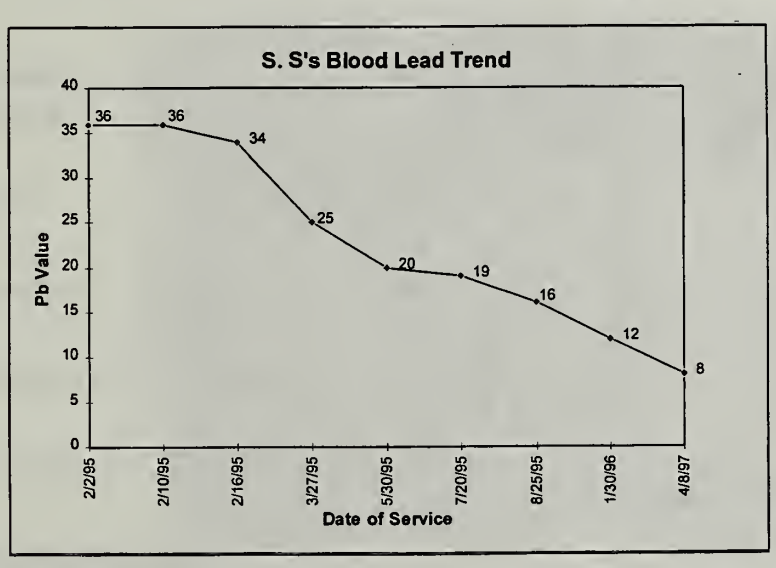
- ***This is a case in which the lead level initially came down, but the child got re-exposed and it spiked up once again. This illustrates the importance of source identification and hazard control as well as retesting.***

- ***In some cases it is difficult to point out one major source and determine whether the elevated lead level is the result of a previous exposure and the children had a high "body burden" of lead; or if a child is being continually re-exposed by small amounts of lead over time.***

V. Ceramic Hazards

Patient SS, Doris Tom, PHN:

A nine-month-old male Hispanic child had an initial fingerstick lead level of 36 µg/dL, followed by a venous lead level of 25 µg/dL. The family lived in a Housing Authority apartment. At the home investigation no obvious source was found; the paint was in good condition and the family denied home remedy use. The PHN asked how the guardian (great-grandparents) prepared and stored the infants' formula. The family responded by showing her a green ceramic pitcher that the family had brought from Oaxaca, Mexico. The baby was given milk three to four times a day from the pitcher. Laboratory analysis showed that both the pitcher and the milk contained dangerous levels of lead. Once the milk was no longer mixed in this pitcher the child's lead level gradually began to drop.



KEY POINTS:

- ***Note that this child was only 9 months old, much younger than the majority of children who are traditionally screened for lead. Because of the child's limited mobility, the PHN was looking for a directly ingested lead source.***

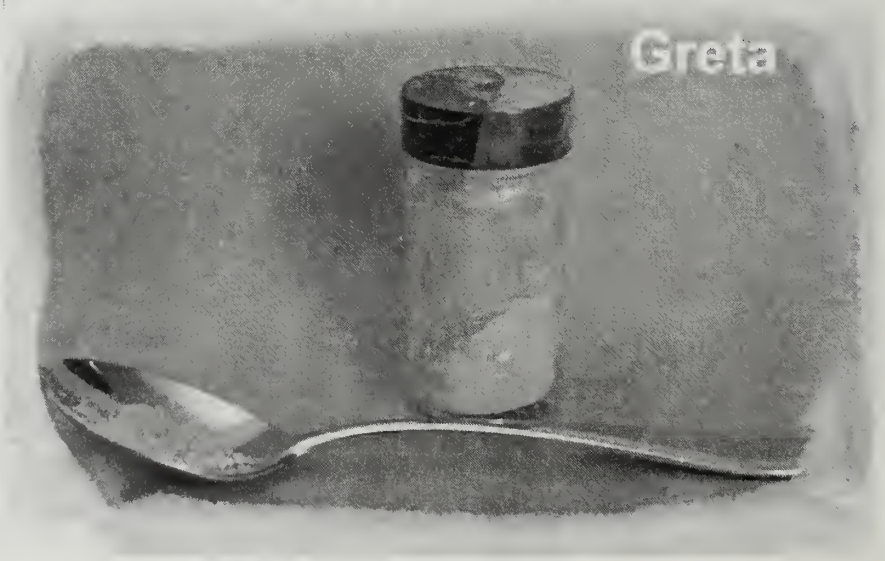
- ***Many of our patients in San Francisco are from other countries and they bring their cooking ware with them. The most frequent examples we have found are the Mexican bean pots, used to cook beans for long periods of time, and water pitchers. These ceramics were not fired at high enough temperatures to prevent the lead glazes from leaching into food and beverages.***

VI. Lead Hazards From Home Remedy Use

KEY POINTS:

- ***Azarcon is the home remedy that our program has most come into contact with is "Azarcon". This is a powder which is used by people from two states in Mexico, primarily Jalisco and Michuacan. It is a bright orange powder. Azarcon's chemical composition is lead oxide and it can contain up to 90% lead. It is used for intestinal upsets (termed "empacho" in Spanish), such as diarrhea, cramping or constipation. It is a smooth muscle relaxant so it might calm the digestive system, however the lead content can then cause more cramping, leading to a vicious cycle.***

- ***This conversation on the following page, between a Public Health Nurse and a patient, may be helpful to you:***



The following conversation occurred between the nurse and the client:

Q: "Did your child have a stomachache recently?"

A "Yes/No." (Even if it is no, I continue).

Q "What medications do you usually give him/her for stomachache?"

While the patient is thinking, as a part of our conversation, I said the following (as a matter of fact):

"In some countries, people sometimes treat stomachaches with yellow or orange powder. The remedy seems to help. Have you ever used this powder/remedy?"

[Note: Don't use the term "home remedies."]

A "Yes/No."

In this case, the mother told me: "Yes, I gave him the orange powder." Our conversation continued.

Q "Did it help?"

A "Yes, he got better."

Q "How much did you give him?"

A "About one teaspoon."

Q "Do you know the name of the powder?"

A "I don't remember, but I still have some left."

Q "Does the name 'Greta' sound familiar?"

A "No."

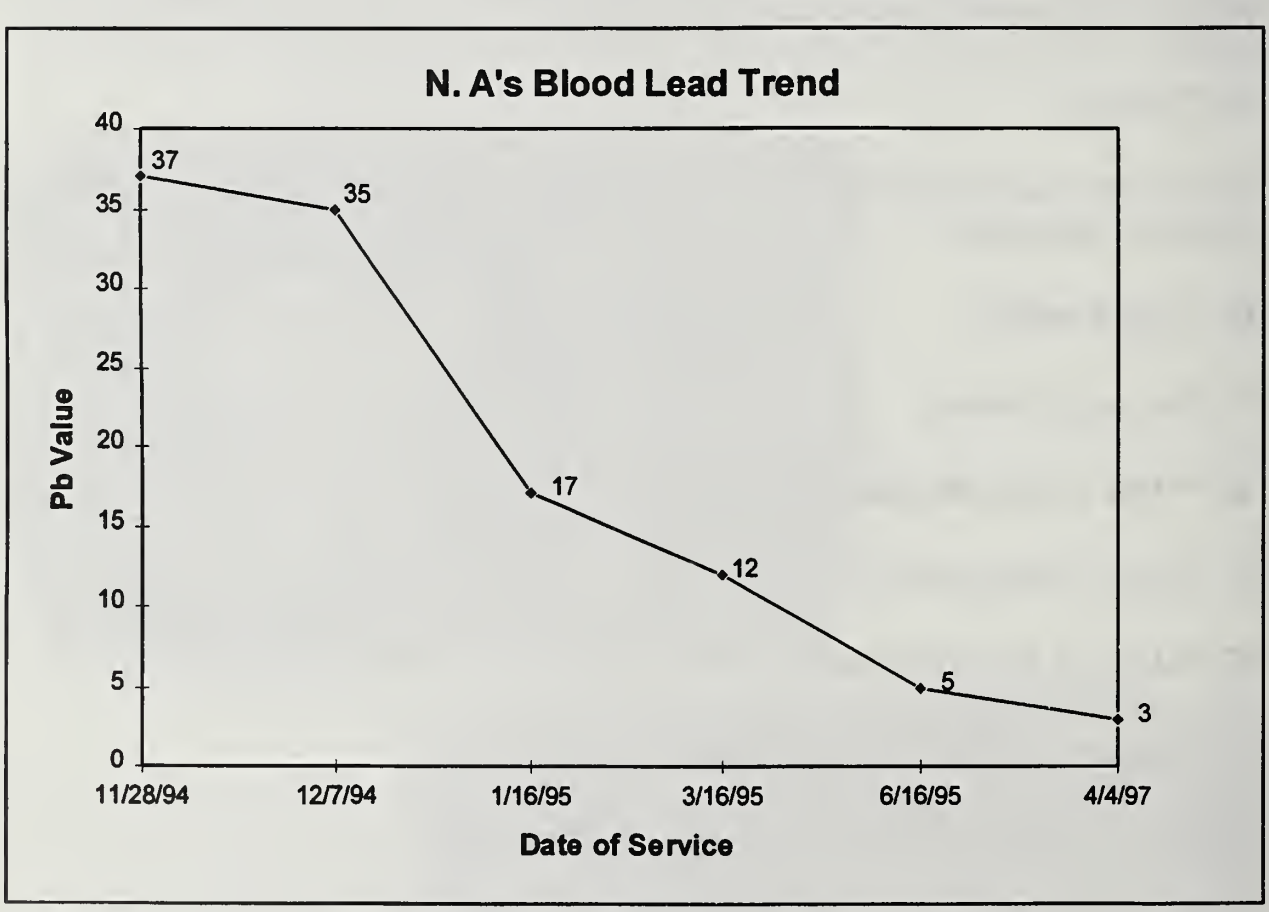
Q "How about 'Azarcon'?"

A "Yes, that's it!"

Next step: Explain increased lead content in remedy and possible substitutes treating stomachaches.

Patient NA, Nora Kabasares, PHN:

A ten-month-old Hispanic girl had an initial venous lead level of 37 µg/dL. The PHN learned that the family had a relative who gave the child a bright orange powder for a stomachache. The family gave the nurse a sample of the powder which was sent for laboratory analysis. It was classified as "Azarcon" and had 85% lead. Although there were some paint hazards in the house, her mother had never observed her eating paint or touching those surfaces. The child was only ten months old and was not that mobile. The father worked in construction, and the mother was also concerned that he may have brought home lead dust from his work. It is believed that the major source of the lead exposure was the administration of the home remedy, because the exposure did not continue and blood lead levels dropped over time.

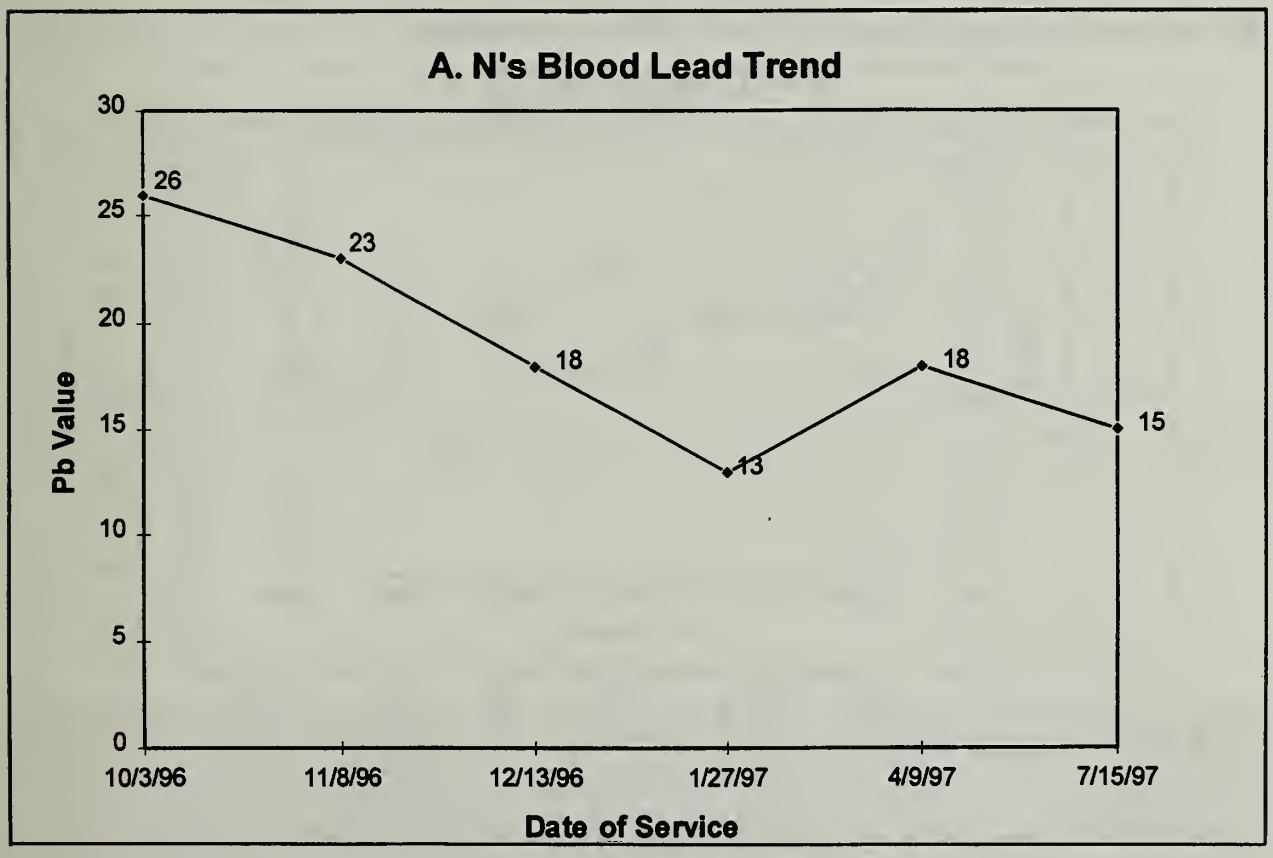


KEY POINT:

☞ ***Note that once again this patient is a ten month-old, younger than the traditionally screened ages of one and two-years of age.***

Patient NA, Elaine Millán, PHN:

A two-year-old Hispanic boy had an initial lead level of 26 µg/dL. During the home investigation very few paint or dust sources were found. Once the nurse established some rapport with the parents, she learned that this child had been treated with Azarcon by a grandparent who resides in Mexico. This child was given Azarcon on three separate occasions prior to his diagnosis. The family stated that he was given one teaspoon of Azarcon each day. In this case the family no longer had the Azarcon, so it was impossible to analyze. Azarcon can contain up to 98% lead. The family clearly described using something which fit this description. Once the Azarcon was discontinued the lead level gradually dropped.



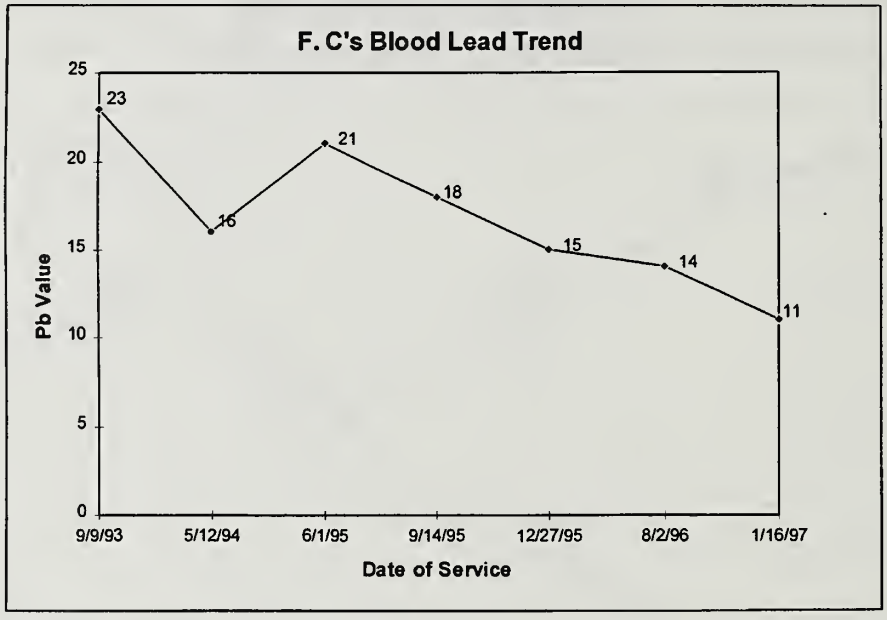
KEY POINT:

- ***Home remedy use should be considered in very young children (especially under one year of age) who appear with elevated lead levels because often they are not mobile enough to access paint or dust lead hazards. Sometimes it is difficult to obtain a sample for analysis from the family.***

VII. Lead Hazards In Cosmetics:

Patient FC, Linda Zimmerman, PHN:

A 20 month-old child from Pakistan had an initial lead level of 23 µg/dL. This child lives in an owner-occupied household with four related families. The child is a member of an extended family, with two children and three cousins all under six years of age. All of the children in the family had elevated lead levels. The children were exposed to contaminated soil and dust. The front and backyard soil had high amounts of lead which are believed to have come from the sand blasting of old paint by previous owners. An additional source of lead exposure for these children was the family's use of surma (a cosmetic from Pakistan). Children were observed eating soil from the contaminated yard. The family discontinued the surma use, planted grass, covered, paved, and replaced the soil with assistance from the Mayor's Office of Housing.



KEY POINTS:

- ***This is an example of a child who might have been exposed to multiple sources, i.e.: lead-containing cosmetics (surma), dust from renovation, and contaminated soil.***

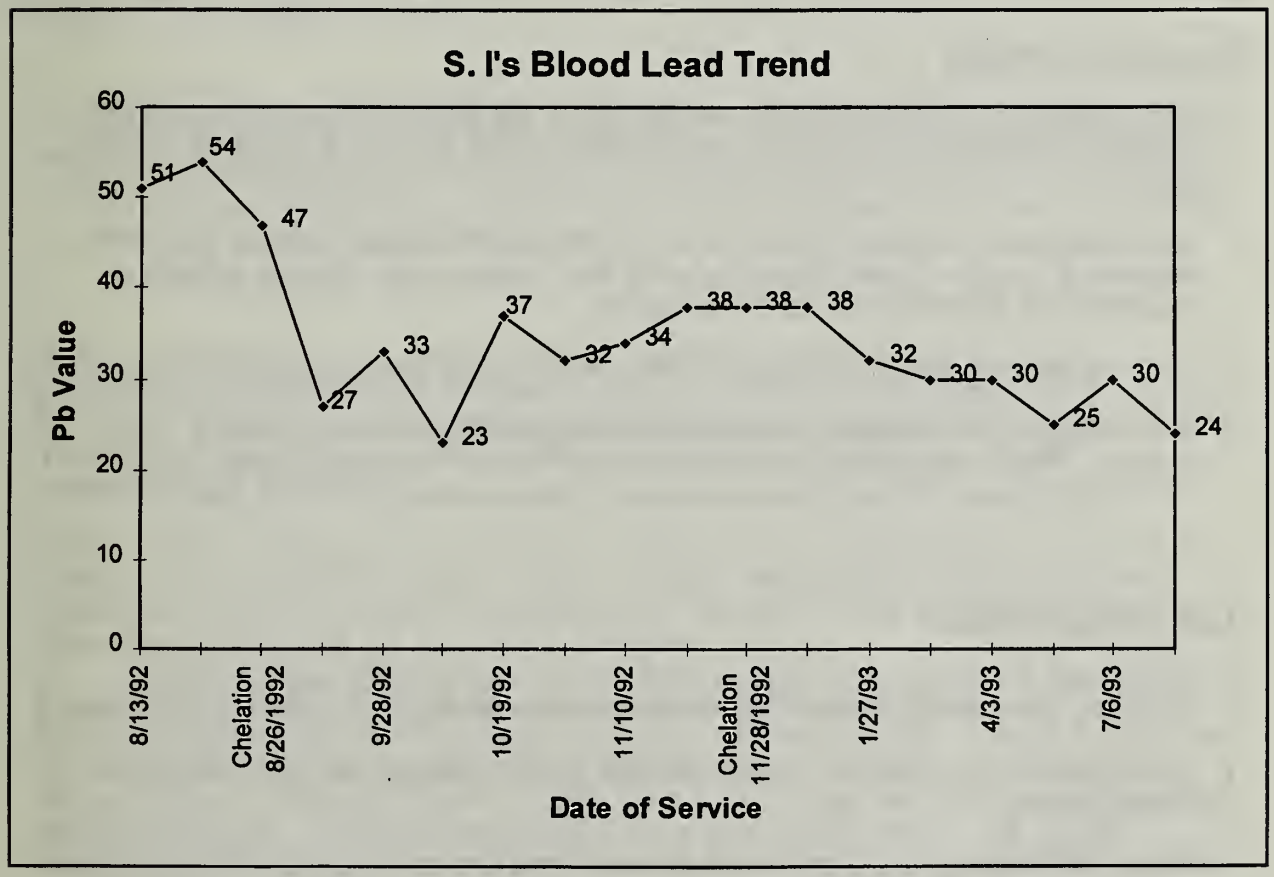
- ***Surma is a cosmetic which comes from the Middle East and Southern Asia, often containing lead. It is used as an eyeliner. It can also be used to "sterilize" the umbilical cord, as well as to "purify" the eyes, on newborns.***

- ***As a result of one child's elevated lead level the family had all of the children tested for lead and found they all had elevated lead levels.***

VIII. Lead Exposure From A Foreign Country Or Travel

Patient IS, Barbara Rothkrug, PHN:

A two-and-a-half-year-old Hispanic child was routinely tested at MNHC. Her initial venous level was 51 µg/dL, (the FEP was 406 and her Ferritin was 6). This child was very anemic and the lead exposure was chronic. Her older brother had an elevated blood lead level of 20 µ/dL. The mother believes that the exposure of her two older children occurred in Mexico. The baby was the only child of three who had not traveled to Mexico, and did not have an elevated blood lead level.



KEY POINT:

- ***Some children bring their lead exposure with them from their country of origin or from travel to foreign countries. Many developing countries have a greater risk of lead exposure due to increased environmental exposure: i.e.: the continued use of leaded gasoline, use of ceramics and home remedies containing lead.***

Lead Poisoning and Iron Nutrition in Children

Information Sheet for Health Care Providers

Iron Status and Lead

- Lack of iron in the diet increases lead absorption from the digestive tract and decreases lead excretion by the body.
- Children who eat too little iron often eat nonfood substances. Excessive eating of nonfood items is called pica. If this includes plaster, paint chips and soil, it can result in further increased lead intake.
- Low income and minority children are more likely to be iron deficient and live in an environment with more sources of lead exposure.

Iron and Anemia

- Hemoglobin is a blood protein, which gives the blood its characteristic red color and helps carry oxygen to the tissues of the body. Hemoglobin contains iron.
- Iron deficiency anemia (**IDA**) is the result of low intake of iron, and/or increased losses of iron from the body due to parasites, chronic infection, microscopic gastrointestinal bleeding etc.
- Iron deficiency anemia affected 15% of California children in 1993.
- It is possible for a child with normal hemoglobin levels to have low iron stores. This is considered iron deficiency without anemia and may affect neurobehavioral development and also increase susceptibility to lead toxicity.

Lead and Anemia

- High lead levels are also directly toxic to red blood cells, reducing their number, size, and function. This is done by reducing hemoglobin synthesis.
- Lead decreases red blood cell formation by preventing the use of iron in hemoglobin.
- **Iron deficiency and elevated blood lead level concentrations often exist together in children.**
- Iron deficiency anemia should be considered in all children with low hemoglobin.

IDA = Iron Deficiency Anemia
MCV = Mean Corpuscular Volume
Hgb = Hemoglobin
TIBC = Total Iron Binding Capacity

How to Diagnose and Measure Iron Status

Hemoglobin (Hgb): This is a measurement of the blood levels of oxygen carrying heme protein It is expressed as grams of Hgb/dL. See Table 1 below, for CDC standards of levels of Hemoglobin which determine (diagnose) anemia. **Low Hgb and Hematocrit are late signs of Iron Deficiency Anemia.**

Table 1. Hemoglobin and Hematocrit Cutoff Values for Iron Deficiency Anemia (IDA) Diagnosis (1)

Age (yr)	Hgb (g/dL)	Hct (%)
1-1.9	11.0	33.0
2-4.9	11.2	34.0
5-7.9	11.5	34.5

Source: CDC 1989

1. Anemia reference values for children are derived from the NHANES II (CDC 1989). Because hematological values change with age, age-specific criteria are used (Dallman and Yip 1984). CDC cutoff values (below which anemia is presumed) for Hgb and Hct for young children of both sexes are listed in Table 1. Health care providers should contact a specialist or reference materials when evaluating individual cases.

Hematocrit: This is a measurement of packed red blood cell volume as a proportion of whole blood. Normal values are 33-49%, depending on the age of the child. When manually performed, hematocrit measurements are less precise. Though hematocrit is roughly proportional to hemoglobin, measuring hemoglobin is preferred.

MCV: Mean corpuscular volume is a measurement of the average size of red blood cells. Low MCV occurs in **IDA**, various hemoglobinopathies and with greatly elevated blood lead concentrations. Normal levels are 76-100 fL or femtoliter, depending on the age of the child.

Ferritin: Iron in excess of need is stored as ferritin, a protein-iron complex. It is a good measure of the long-term adequacy of iron storage. This is considered the most definitive and accurate indicator of overall iron status. It can be elevated due to chronic disease or infection, which must be ruled out when using ferritin levels to evaluate iron status. **Ferritin levels below 12 ng/ml suggest inadequate iron intake.** Early in **IDA** ferritin may decrease to low levels before, (2-4 weeks), frank anemia, with low **Hgb** ensues.

Serum Iron: This is the total (bound) concentration of iron in serum. It reflects recent intake and is generally low (< 50 ug/dL) in **IDA**. While ferritin is a better test, serum iron is more easily measured and is often expressed as a ratio to transferrin (see below).

IDA = Iron Deficiency Anemia
MCV = Mean Corpuscular Volume
Hgb = Hemoglobin
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Free erythrocyte protoporphyrin (FEP, EP or ZPP): Protoporphyrin is a precursor of hemoglobin formation and will accumulate when there is either insufficient iron or excessively high levels of lead present. Because FEP levels take about 2 weeks to increase, EP levels may indicate the duration of lead exposure. If exposure to lead has ceased, FEP levels will decrease over several weeks or months. FEP is **not** a good screening test for lead exposure.

Transferrin: Most of the iron in serum is bound to transferrin. The decrease in serum iron or an increase in transferrin (roughly equivalent to the total iron-binding capacity, **TIBC**) result in decreased transferrin saturation (serum iron/iron-binding capacity). **Transferrin saturation less than 16% suggest iron deficiency.**

Progression to Iron Deficiency Anemia (IDA)

The progression to **Iron Deficiency Anemia** is gradual:

The first step is the exhaustion of iron stores, (**low ferritin, < 12 ng/ml, low transferrin saturation, ≤ 16 %**).

Next one sees reduced heme production (**reduced Hgb**) and size, number, and function of blood cells (**reduced MCV and Hct**)

To measure the presence of **Iron Deficiency Anemia**, begin by:

a. measuring **MCV, Hgb** or **CBC** (complete blood count). The most common cause of low **MCV** and low **Hgb** is **IDA**. These two tests are usually sufficient when poor nutrition or blood loss are likely causes. Lead is not likely to cause an anemia (**Hgb < 11**) until lead concentrations are **> 60 ug/dL**;

b. measure storage **ferritin**, if cause of anemia is unclear;

c. then evaluate response to treatment (rising **Hgb** with iron repletion indicates **Iron Deficiency Anemia**).

To determine the presence of **IDA**, the tests that are most useful are:
Hemoglobin, Ferritin and Serum Iron.

Many other factors can cause anemia, including **sickle cell anemia** and **thalassemia major. Thalassemia major** is an inherited blood disorder in which affected individuals are unable to make enough red blood cells.

While thalassemia major is not common, **thalassemia trait** with mild expression which may look like **Iron Deficiency Anemia** is common in some populations(up to 5% prevalence) and should be considered. Thalassemia trait is most common in African Americans and some Southeast populations.

Nutrition and Lead Poisoning Prevention

Calcium, iron and other mineral nutrients are also important in reducing lead absorption. Nutritional counseling to encourage intake of foods high in these nutrients is an important part of secondary prevention of low level childhood lead poisoning.

IDA = Iron Deficiency Anemia
MCV = Mean Corpuscular Volume
Hgb = Hemoglobin
TIBC = Total Iron Binding Capacity

The following foods are good sources of Iron and/or Calcium

(§ This symbol indicates foods which are good sources of both iron and calcium)

- **Iron-fortified formulas** §
- **Iron-fortified cereals** (These can include cream of wheat, rice and grits as well as cold cereals. Look for the word **enriched**, or an RDA for iron of 50% or greater on the label).
- **Meat, Fish and Poultry** (Red meat and dark poultry meat have more iron than white meat)
- **Beans (such as lentils, black beans, pintos, and navy beans)** (More iron is absorbed from cooked dry beans which have a little meat added or are served with good sources of vitamin C (**see Foods rich in Vitamin C below**). §
- **Dark leafy greens** (all greens except for spinach, chard and beet greens, which contain high amounts of oxalic acid. This binds the calcium and prevents its absorption). §
- **Regular, low fat or Nonfat Milk, Cheese, Yogurt, Frozen Yogurt or Ice Milk**
- **Corn tortillas** (treated with lime or calcium carbonate)
- **Canned salmon or sardines** (when you eat the soft bones these contain) §

Foods cooked in cast iron cookware (Tomato sauces and other acid or slow-cooked foods draw iron from the pot and into the food)

Iron supplements may be needed to treat children with IDA. Calcium carbonate and calcium citrate supplements may be needed when children do not tolerate milk and milk products and are failing to get enough calcium from other high-calcium foods. **Iron supplements taken with calcium foods or supplements may decrease uptake of the inorganic iron.**

Nutritional supplements should only be considered as an adjunct to a balanced diet.

Foods rich in Vitamin C include: Citrus, Peppers, Kiwi, Strawberries, Melons, Broccoli, Cabbage

CHDP has a bilingual (Spanish and English) patient education handout on "Food Tips to Protect Your Child from Lead Poisoning". To order copies call CHDP at (415) 554-9950.

This handout was developed by Laura Brainin-Rodriguez, M.P.H., M.S., R.D., from work done by Asa Bradman Ph.D., with the assistance of Marion Koerper, M.D. and John Osterloh, MD and Asa Bradman, Ph.D..

IDA = Iron Deficiency Anemia
MCV = Mean Corpuscular Volume
Hgb = Hemoglobin
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LEAD

Medical Record Card or Write in:

Child's name:
Birthdate:
Date:

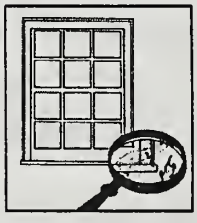
Has your child been exposed to lead?

1. Does your child live or stay in a place older than **1960**?
☐Yes ☐No ☐Don't Know

2. Does this place have **peeling paint**?
☐Yes ☐No

3. Does this place have **bare soil**?
☐Yes ☐No

4. Has this place been **remodeled or repainted** recently?
☐Yes ☐No



5. Does your child **play at window sills** or open windows that have peeling paint, paint chips or crumbled paint?
☐Yes ☐No

6. Does your child **eat or chew things that are not food**, like paint chips or dirt? ☐Yes ☐No

7. Is your child **anemic** or low in iron?
☐Yes ☐No

8. Does your child spend time or **play in the same places with other children who have had lead in their blood?** ☐Yes ☐No

9. Has your child recently lived or **visited another country?**
☐Yes ☐No

10. Does your child **live or stay with someone who uses lead in their job**? (For example, painting, construction work, solder, car batteries, radiators, cables, inks, dyes, glazes, bronze, or brass.)
☐Yes ☐No

11. Does your child live or stay with someone who **uses lead for a hobby**? (For example, soldering, stained glass, bullets, fishing sinkers, home repair or renovation, or glazed pottery)?
☐Yes ☐No

12. Does your child's family **take medicine from other countries**? (for example some people take a yellow powder called Greta or an orange powder called Azarcon for diarrhea or "empacho")?
☐Yes ☐No ☐Don't Know

13. Do you use **pottery or ceramic dishes** for cooking, eating, or drinking that come from other countries (Like Mexico, China, Italy, etc.), or are hand made?
☐Yes ☐No

14. Does your child's family wear **make-up** from Asia, the Middle East or Africa (called Surma or Kohl)?
☐Yes ☐No

If you answered "yes" to any of the above questions, your child is considered at risk for lead poisoning. See the child's doctor for a blood lead test.

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